

U.S. Patent Application Serial No. 09/939,716
Amendment filed April 18, 2008
Reply to OA dated February 21, 2008

REMARKS:

Claims 10-17 and 24 are currently pending. Claim 10 has been amended herein. Claim 24 has been newly added herein. Claim 19 has been canceled herein without prejudice or disclaimer as to its subject matter.

The Examiner has indicated that claims 16 and 17 set forth allowable subject matter (Office Action dated November 21, 2007; page 1, item 7; page 9, paragraph 6).

1. The Examiner has rejected claims 10-12, 14, 15, and 19 under 35 U.S.C. §103(a) as obvious over U.S. Patent No. 5,543,952 (Yonenaga '952) in view of XP000227527 (Chung '527).

Applicants respectfully traverse this rejection, for the following reasons.

There are substantial, important differences between the art relied upon by the Examiner and the features set forth in the claims in issue.

Yonenaga '952 and **Chung '527**, alone or in combination, fail to describe, teach, or suggest the combination of features set forth in claim 10, as amended, including at least the following features:

applying the amplified electrical signal to said electrical-optical conversion means, said electrical-optical conversion means having a traveling wave type electrode operating to restrict bandwidth of an output light of said electrical-optical conversion means, wherein

said electrical-optical conversion means is a Mach Zehnder light intensity modulator having a traveling wave type electrode,

bandwidth of optical output of said Mach Zehnder light intensity modulator is restricted by using mismatching of phase velocity of electric wave propagating on said traveling wave type electrode and optical wave propagating in an optical waveguide having refractive index depending upon electrical field generated by said electric wave, ...

said traveling wave type electrode is designed so that phase change of optical wave propagating in said optical waveguide depending upon said electrical field has waveforms of a ternary duobinary signal.

According to the features set forth in the subject application, an electrical binary signal is applied to an input terminal, and the electrical binary signal is processed by a precoding means.

The precoding means provides an output which is the same as the previous output when an input binary digital signal is 0, and an output which differs from the previous output when an input digital signal is 1. It is clear from this process that output of the precoding means is still binary signal, and the electrical binary signal is amplified at an amplifier, and then applied to an electrical-optical conversion means having a traveling wave type electrode.

Claim 10 sets forth: "said traveling wave type electrode is designed so that phase change of optical wave propagating in said optical waveguide depending upon said electrical field has waveforms of a ternary duobinary signal."

According to the features disclosed by the subject application, the signal applied to the electrical-optical conversion means is the electrical binary signal, and a ternary duobinary signal is generated by the traveling wave type electrode in the electrical-optical conversion means.

However, according to **Yonenaga '952**, an electrical binary signal is converted to a duobinary signal at the encoding circuit 80, and the duobinary signal is applied to an electrical-optical conversion means (see column 5, lines 58-65 of **Yonenaga '952**).

As described in the "Background of the Invention" of the specification of the subject application (see page 6, line 17 to Page 7, line 16), it is important to keep waveform when the ternary duobinary signal is generated in electrical domain. However, it requires an amplifier which has fine linearity.

Normally the amplifier used for a conventional system does not have fine linearity, and normally the amplifier used for a conventional system causes a severe inter-symbol interference.

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Moreover, inter-symbol interference is emphasized by reflection between the duobinary filter and the amplifier and/or reflection between the amplifier and the optical modulator.

Due to the inter-symbol interference, the receive sensitivity and the dispersion tolerance are degraded, and as a result, transmission distance is decreased.

The features disclosed in the subject application do not use the electrical ternary duobinary signal, in contrast to the configuration disclosed in **Yonenaga '952**, and apply the electrical binary signal to the electrical-optical conversion means which generates ternary duobinary signal. Therefore, it is possible to use the conventional amplifier without causing the inter-symbol interference according to the features disclosed in the subject application.

Further, because the features disclosed in the subject application do not require the duobinary filter, it is possible to reduce components inside the transmitter. Because of fewer components, it is possible to prevent the reflection which causes the inter-symbol interference.

Chung '527 discloses that the bandwidth is restricted due to the loss of the traveling wave type electrode or mismatching of phase velocity. However, **Chung '527** does not teach that a ternary duobinary signal can be generated from an electrical binary signal at the electrical-optical conversion means having the traveling wave type electrode in addition to electrical-optical conversion. In other

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words, **Chung '527** fails to tell that a MZI can simultaneously act as a duobinary filter and an electrical optical converter.

Especially, **Chung '527** states as follows in "V. Summary" (Page 616, left column):

"Our calculated results indicate that both increasing the electrode thickness and increasing the buffer layer thickness significantly reduce optical-electrical velocity mismatch (by reducing the effective microwave index); consequently, they will increase the bandwidth for a given electrode length."

From the above statement, it is very clear that **Chung '527** teaches how to match the phase velocity, and that is opposite to the features of the subject application which utilize mismatch of phase velocity to create a ternary duobinary signal.

Yonenaga '952 and **Chung '527**, alone or in combination, fail to describe, teach or suggest that the electrical-optical conversion means having the traveling wave type electrode can be used as the duobinary filter in addition to E/O converting function, and fail to describe, teach, or suggest that, with this configuration, it is possible to prevent inter-symbol interference.

Applicants submit that it would not have been obvious to combine/modify **Yonenaga '952** and **Chung '527** in order to arrive at the features set forth in **claim 10**, as amended.

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In view of the above, the Examiner has not yet established a *prima facie* case of obviousness. But it is the burden of the Examiner to do so. The U.S. Patent and Trademark Office has the burden of proof to show that an applicant is not entitled to a patent if the claimed subject matter is anticipated by, or is obvious from, the art of record. A patent applicant is entitled to a patent "unless" the U.S. Patent and Trademark Office establishes otherwise. See, e.g., *In re Dembiczak*, 175 F.3d 994, 1001 (Fed. Cir. 1999); *In re Epstein*, 32 F.3d 1559, 1564 (Fed. Cir. 1994); *In re Rijckeart*, 9 F.3d 1551, 1552 (Fed. Cir. 1992); *In re Fine*, 837 F.2d 1071, 1074 (Fed. Cir. 1988).

In view of the foregoing amendments and remarks, it is respectfully believed that essential elements of a *prima facie* case of obviousness are missing. The above-referenced art, cited and relied upon by the Examiner, does not describe, teach, or suggest the combination of features as set forth in **claim 10**, as amended.

Accordingly, Applicants respectfully submit that the Examiner has not established a *prima facie* case regarding **claim 10**, as amended.

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Yonenaga '952 and **Chung '527**, alone or in combination, fail to describe, teach, or suggest the combination of features set forth in claim 10, as amended, including at least the following features:

applying the amplified electrical signal to said electrical-optical conversion means, said electrical-optical conversion means having a traveling wave type electrode operating to restrict bandwidth of an output light of said electrical-optical conversion means, wherein

said electrical-optical conversion means is a Mach Zehnder light intensity modulator having a traveling wave type electrode,

bandwidth of optical output of said Mach Zehnder light intensity modulator is restricted by using mismatching of phase velocity of electric wave propagating on said traveling wave type electrode and optical wave propagating in an optical waveguide having refractive index depending upon electrical field generated by said electric wave, ...

said traveling wave type electrode is designed so that phase change of optical wave propagating in said optical waveguide depending upon said electrical field has waveforms of a ternary duobinary signal.

Accordingly, in view of the above, Applicants respectfully submit that this rejection of claim 10 should be withdrawn. Also, it is submitted that this rejection of claims 11, 12, 14, and 15 should be withdrawn by virtue of their dependency. The rejection of claim 19 is moot.

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2. The Examiner has rejected claim 13 under 35 U.S.C. §103(a) as obvious over U.S. Patent No. 5,543,952 (Yonenaga '952), XP000227527 (Chung '527), and U.S. Patent No. 5,271,074 (Tocci '074).

Applicants respectfully traverse this rejection, for the following reasons.

The disclosure of **Tocci '074** fails to remedy the above-discussed deficiencies of **Yonenaga '952** and **Chung '527** regarding the base claim 10. **Yonenaga '952**, **Chung '527**, and **Tocci '074**, alone or in combination, fail to describe, teach, or suggest the combination of features set forth in claim 10, as amended, including at least the following features:

applying the amplified electrical signal to said electrical-optical conversion means, said electrical-optical conversion means having a traveling wave type electrode operating to restrict bandwidth of an output light of said electrical-optical conversion means, wherein

said electrical-optical conversion means is a Mach Zehnder light intensity modulator having a traveling wave type electrode,

bandwidth of optical output of said Mach Zehnder light intensity modulator is restricted by using mismatching of phase velocity of electric wave propagating on said traveling wave type electrode and optical wave propagating in an optical waveguide having refractive index depending upon electrical field generated by said electric wave, ...

said traveling wave type electrode is designed so that phase change of optical wave propagating in said optical waveguide depending upon said electrical field has waveforms of a ternary duobinary signal.

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Accordingly, in view of the above, Applicants respectfully submit that this rejection of claim 13 should be withdrawn by virtue of its dependency.

3. The Examiner has objected to claims 16 and 17 as being dependent upon a rejected base claim.

The Examiner has indicated that claims 16 and 17 set forth allowable subject matter. The Examiner has noted that claims 16 and 17 would be allowable if rewritten in independent form including the limitations of the base claim and any intervening claims.

It is submitted that the objection to claims 16 and 17 is an objection or requirement as to form not necessary to further consideration of claims 16 and 17. Applicants respectfully request that the Examiner hold this objection in abeyance while considering the remarks herein regarding claim 10.

4. Claim 24

Claim 24 has been newly added herein.

Applicants respectfully submit that **Yonenaga '952**, **Chung '527**, and **Tocci '074**, alone or in combination, fail to describe, teach, or suggest the combination of features set forth in claim 24,

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including at least the following features:

applying the amplified electrical signal to said electrical-optical conversion means, said electrical-optical conversion means having a traveling wave type electrode operating to restrict bandwidth of an output light of said electrical-optical conversion means, wherein said electrical-optical conversion means is a Mach Zehnder light intensity modulator having a traveling wave type electrode, bandwidth of optical output of said Mach Zehnder light intensity modulator is restricted because of loss of said traveling wave type electrode, ... said traveling wave type electrode is designed so that phase change of optical wave propagating in said optical waveguide depending upon said electrical field has waveforms of a ternary duobinary signal.

5. Information Disclosure Statement Filed on August 28, 2001

Applicants filed an Information Disclosure Statement on August 28, 2001. Applicants have not yet received a copy of the PTO Form 1449 with the Examiner's signature showing that the documents listed therein have been considered by the Examiner.

At this time, Applicants respectfully request that the Examiner provide the appropriate PTO Form 1449, showing that the documents listed therein have been considered by the Examiner.

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If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact the Applicants' undersigned attorney at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed, the Applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due now or in the future with respect to this application, to Deposit Account No. 01-2340.

Respectfully submitted,
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Enclosure: Petition for Extension of Time